

## **REMARKS**

Claims 1-19 are pending and are rejected by the Examiner. In this response, Claims 1, 14 and 18 have been amended, Claims 12, 13, 15 and 16 have been canceled and no claims have been added. Accordingly, Claims 1-11, 14 and 17-19 are pending.

### **I. Rejection Under 35 U.S.C. § 112, second paragraph**

In the Office Action, the Examiner has rejected Claims 12, 13, 15 and 18 under 35 U.S.C. § 112, second paragraph for various informalities. These matters are believed to be addressed by the claim amendments submitted herewith. Accordingly, Applicant respectfully requests that the rejection under 35 U.S.C. § 112, second paragraph, be withdrawn.

### **II. Rejection Under 35 U.S.C. § 112, first paragraph**

Claims 12, 13 and 15-16 are rejected under 35 U.S.C. § 112, first paragraph, as containing subject matter which was not described in the specification. In response, Applicant has canceled these claims. Accordingly, Applicant respectfully requests that the rejection under 35 U.S.C. § 112, first paragraph, be withdrawn.

### **III. Rejection Under 35 U.S.C. § 102(b)**

The Examiner applied a number of rejections with respect to Claims 1 and 14 and their dependent claims. Specifically, Claims 1, 11 and 14 are rejected under 35 U.S.C. §102(b) as being anticipated by or alternatively obvious over Steckl et al., "Review of Focused ion beam mixing for the fabrication of GaAs based optoelectronic devices", J. Vac. Sci. Technol. B, Vol. 13(6) pp 2570-2575 (11/12-1995) ("Steckl"). Claims 1, 3-5, 11, 14 and 16-19 are rejected under 35 U.S.C. §102(b) as being fully anticipated by Jung et al. "Atomic Transport by Ion Beam Mixing in the Radiation Enhanced Diffusion Region", Mat. Res. Soc. Symp. Proc. Vol. 354 pp 21-26 (1995) ("Jung"). Claims 1, 11 and 14 are rejected under 35 U.S.C. §102(b) as being fully anticipated by Kanayama et al., "Fine Pattern Definition with Atomic Intermixing Induced by Focused Ion Beam and Its Application to X-ray Mask Fabrication", J. Vac. Sci. Technol. B, Vol. 9(2) pp 296-301 (4/1991) ("Kanayama"). Claims 1, 3-5, 11, 14 and 16-19 are rejected under 35 U.S.C. §102(b) as being fully anticipated by Amaral et al., "Very Thin Fe/Ni modulation

multilayer Films Under Ion Bombardment”, J. Appl. Phys., vol. 81(8) pp 4773-4775 (04/1997) (“Amaral”). To the extent that the rejection applies to the amended claims, Applicant respectfully traverses these rejections.

With respect to independent Claims 1 and 14, Applicant has amended these claims to specify that the light ions, recited in Claims 1 and 14, are ions having a mass less than 16 atomic mass units. Applicant notes that this amendment is supported by the original disclosure. Please see page 4, lines 25-27 of the original disclosure.

Applicant respectfully submits that none of the cited references use light ions having a mass less than 16 units of atomic mass. Specifically, Steckl fails to teach irradiating by means of a beam of light ions, wherein the light ions are defined as ions having a mass less than 16 atomic mass units, as recited in independent Claims 1 and 14. Rather, Steckl teaches using a beam of heavy ions ( $\text{Si}^{++}$  ions). Since Steckl does not disclose use of light ions as defined by the claims, the rejection of Claims 1, 11 and 14 as being anticipated by Steckl should be withdrawn.

With respect to the rejection of Claims 1, 3-5, 11, 14 and 16-19 based on Jung reference, Applicant submits that Jung fails to teach or suggest a process in which a multi-layer material composed of thin layers is (1) irradiated by means of a beam of light ions having an energy of the order of or less than a hundred KeV, wherein the light ions are ions having a mass less than 16 atomic mass units and (2) the irradiation dose is controlled so as to be a few  $10^{16}$  ions/cm<sup>2</sup> or less, recited in independent Claims 1 and 14. Rather, Jung teaches using a beam of heavy ions ( $\text{Ar}^+$  ions) that modify the chemical composition of different layers of the multi-layer material when it is irradiated. As a result, the irradiation process taught by Jung causes formation of a mixed region and does not permit maintaining the multilayer structure. Since Jung does not disclose use of light ions as defined by the claims, the rejection of Claims 1, 3-5, 11, 14 and 16-19 as being anticipated by Jung should be withdrawn.

As to the rejection of Claims 1, 11 and 14 based on Kanayama reference, Applicant submits that Kanayama fails to teach or suggest a process in which a multi-layer material composed of thin layers is (1) irradiated by means of a beam of light ions having an energy of the order of or less than a hundred KeV, wherein the light ions are ions having a mass less than 16 atomic mass units and (2) the irradiation dose is controlled so as to be a few  $10^{16}$  ions/cm<sup>2</sup> or less, recited in independent Claims 1 and 14. Instead, Kanayama teaches using a beam of heavy ions ( $\text{Kr}^+$  ions) that modify the chemical composition of different layers of the multi-layer

material when it is irradiated. As a result, the irradiation process taught by Kanayama causes formation of a mixed region and does not permit maintaining the multilayer structure. Since Kanayama does not disclose use of light ions as defined by the claims, the rejection of Claims 1, 11 and 14 as being anticipated by Kanayama should be withdrawn.

With respect to the rejection of Claims 1, 3-5, 11, 14 and 16-19 based on Amaral reference, Applicant submits that Amaral fails to teach or suggest a process in which a multi-layer material composed of thin layers is (1) irradiated by means of a beam of light ions having an energy of the order of or less than a hundred KeV, wherein the light ions are ions having a mass less than 16 atomic mass units and (2) the irradiation dose is controlled so as to be a few  $10^{16}$  ions/cm<sup>2</sup> or less, recited in independent Claims 1 and 14. Rather, Amaral teaches using a beam of heavy ions that destroy and modify the chemical composition of different layers of the multi-layer material when it is irradiated. As a result, the irradiation process taught by Amaral causes formation of a mixed region and does not permit maintaining the multilayer structure. Additionally, Applicant notes that the dosages indicated in Amaral are  $10^{17}$  ions/cm<sup>2</sup>, which is greater than the irradiation dose set forth in the independent claims. Furthermore, Amaral teaches away from the use of the light ions such as He<sup>+</sup> ions because in the Amaral reference, He<sup>+</sup> ions are presented as being “less effective”. In this regard, Amaral discloses that mixing with Ne is “more effective than with He<sup>+</sup> ions of similar dose.” Accordingly, the rejection of Claims 1, 3-5, 11, 14 and 16-19 as being anticipated by Amaral should be withdrawn.

#### **IV. Rejection Under 35 U.S.C. § 103(a)**

Claims 1, 2, 11 and 14 are rejected under 35 U.S.C. §103(a) as being unpatentable over Steckl. Claims 1-19 are rejected under 35 U.S.C. §103(a) as being unpatentable over Amaral in view of Steckl. To the extent that the rejection applies to the amended claims, Applicant respectfully traverses these rejections.

To establish a prima facie case of obviousness, the cited references when combined must teach or suggest all the claim limitations. As noted above, neither Steckl nor Amaral teach or suggest using light ions having a mass less than 16 units of atomic mass, as recited in independent Claims 1 and 14. Accordingly, Claims 1-11, 14 and 17-19 are allowable over Amaral in view of Steckl. Claims 1, 2, 11 and 14 are patentable over Steckl.

## CONCLUSION

In view of the foregoing, it is submitted that the claims are in condition for allowance. Reconsideration of the rejections and objections is requested. Allowance is earnestly solicited at the earliest possible date. If there are any fees due in connection with the filing of this response, please charge those fees to our Deposit Account No. 02-2666. If a telephone interview would expedite the prosecution of this Application, the Examiner is invited to contact the undersigned at (310) 207-3800.

Respectfully submitted,

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### **CERTIFICATE OF MAILING:**

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Marilyn Bass

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